



APEX for E-Business Suite goes Mobile: Extending EBS Seamless & Secure on Desktop and Mobile

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ACEs@Home | November 03, 2020



ACEs
@home

ORACLE | Partner

PROMATIS GROUP – AT A GLANCE



140 +
Employees



14 Mio €
Total revenues 2019
Plan 2020: 14 Mio €



1994
Economically successful since foundation
(EBIT positive) and Oracle partner



4 countries
DE: Ettlingen, Berlin,
Hamburg, Muenster
AT: Vienna
CH: Zurich
US: Denver, CO



Experts
for ERP, SCM, EPM, HCM, CX, PPM, GRC



Ettlingen
Headquarters
(Karlsruhe TechnologyRegion)



100%
Project success rate since
formation



Pioneer
In the process-oriented introduction
of Oracle applications – SaaS,
BPM, SOA



20+ countries
International project experience



Owner
-managed company



Competence
in data analytics, integration, BPM,
SOA, CM, IoT, AI, ...



Excellence
Business, digitalization and comprehensive
Oracle excellence from one source

AGENDA



1	What is APEX?
2	Integration between Oracle EBS and APEX
3	APEX on Mobile / PWA
4	Summary



1 What is APEX?

Overview

History

Main features

Architecture

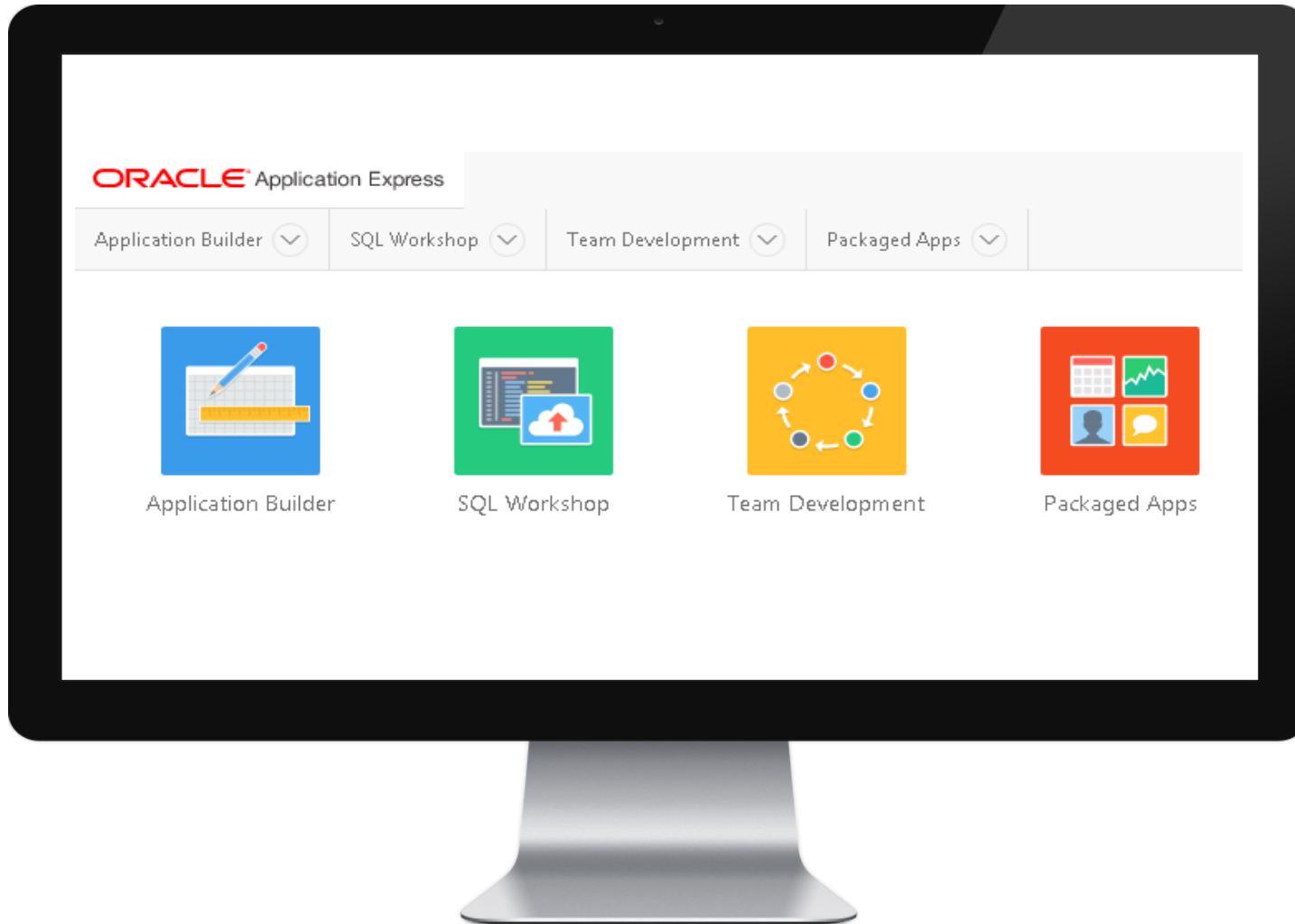
2 Integration between Oracle EBS and APEX

3 APEX on Mobile / PWA

4 Summary

WHAT IS APEX?

OVERVIEW



- Low-code development platform (SQL, PLSQL, JavaScript, html)
- Part of every Oracle database (no separate license)
- Built up scalable and responsive web applications on top of the Oracle database
- Easy to learn for database developers
- Mobile and Responsive Themes

WHAT IS APEX? HISTORY



Oracle
HTML DB,
Version 1.5,
2004

- First Release

APEX,
Version 3.1,
Spring 2008

- Interactive Reports

APEX, Version 4.2,
October 2012

- Mobile- and Responsive Themes, HTML 5 support

APEX,
Version
5.1, 2017

- Interactive Grid, Jet Charts

APEX,
Version 2.1,
January
2006

- Renaming to APEX

APEX,
Version 4.0,
June 2010

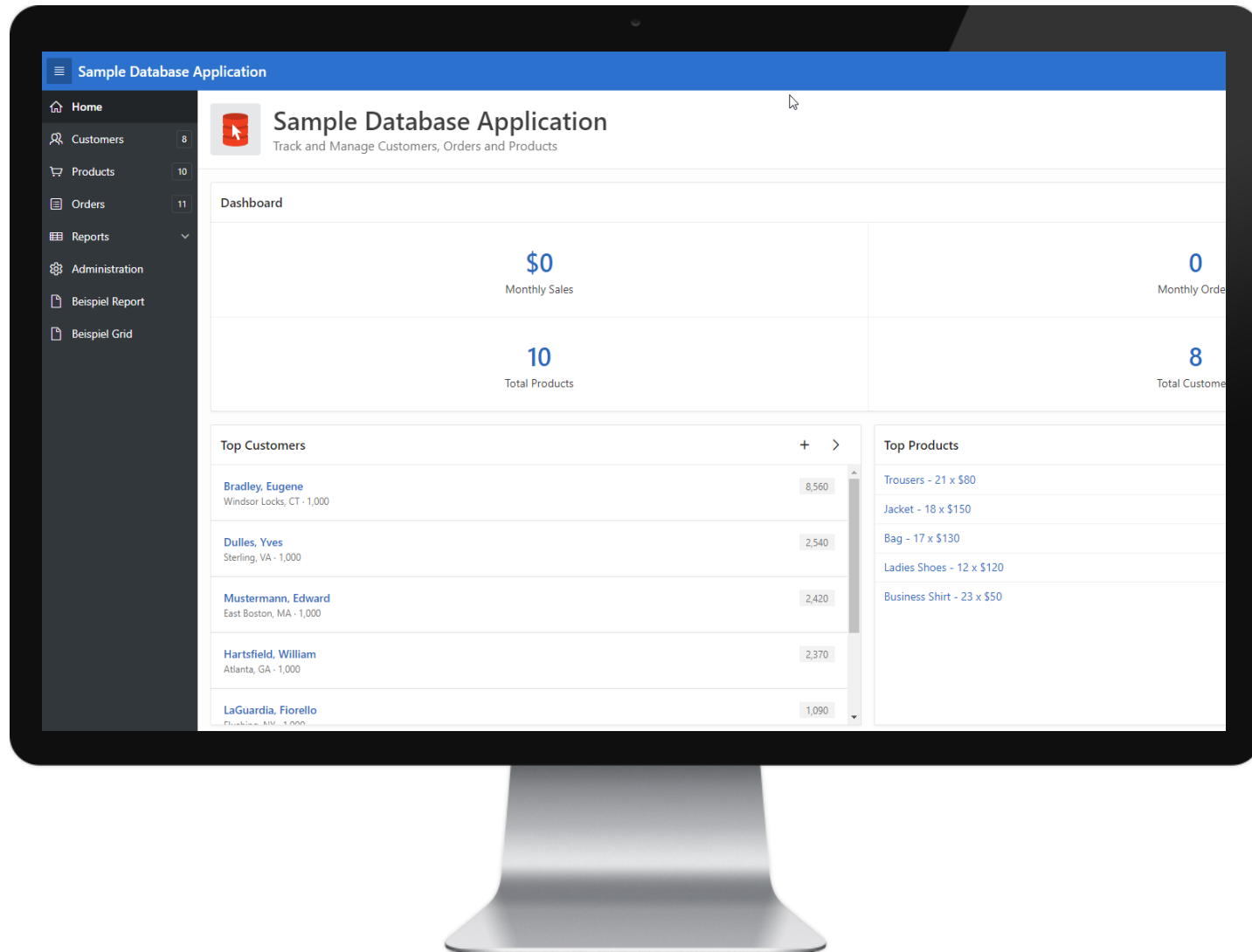
- Dynamic Actions

APEX,
Version 5.0,
April 2015

- Page Designer, Universal Theme

WHAT IS APEX?

MAIN FEATURES



- Modifiable reports, which can be exported i.e. as .csv files
- Forms to enter, modify or delete data in database tables

WHAT IS APEX?

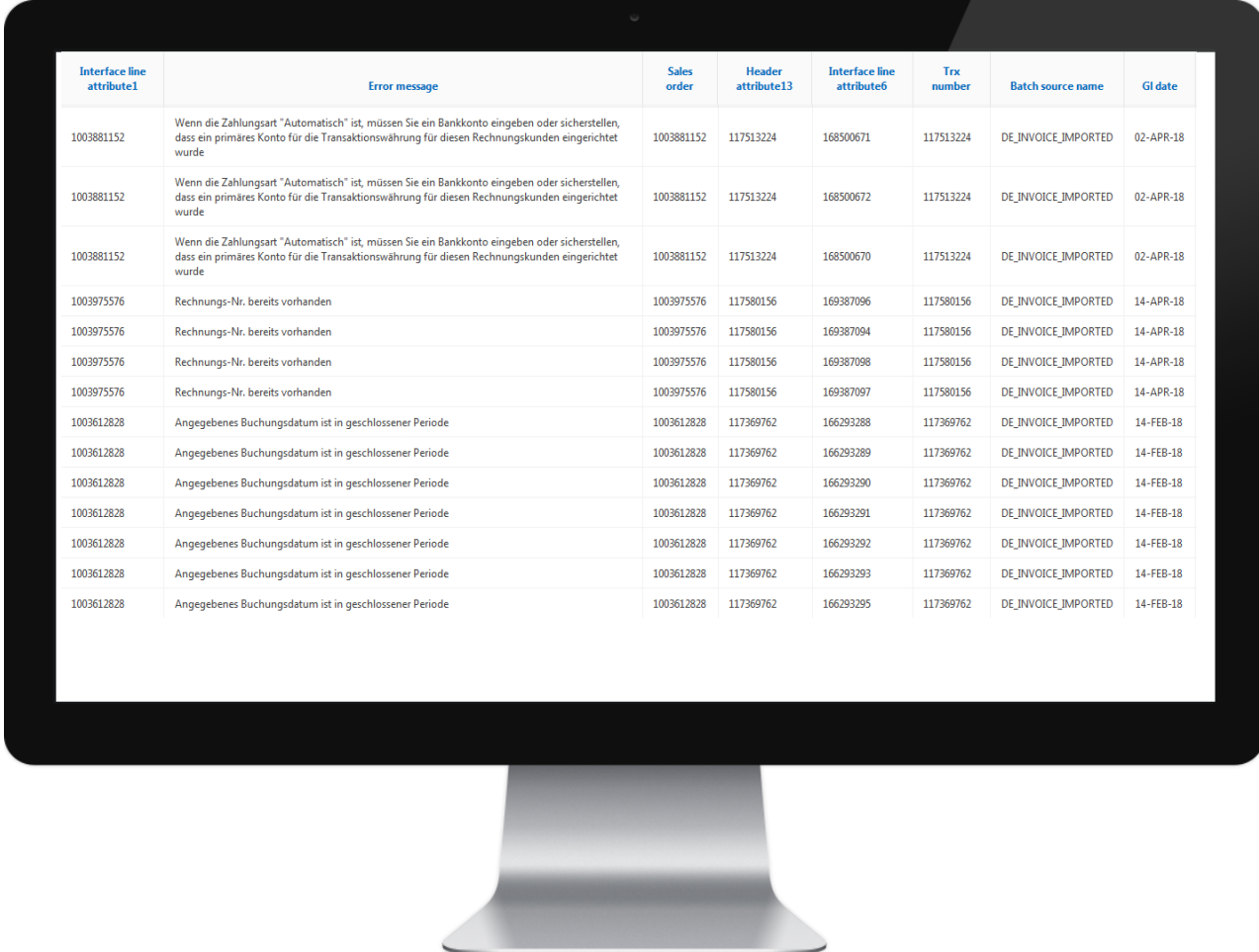
MAIN FEATURES – COMMON USE CASES



- Visualize and maintain data
- Extending enterprise applications like the Oracle E-Business Suite
- Modernizing legacy applications
- Webifying desktop tools and spreadsheets
- Allow Access from mobile devices – with some work even 'Offline'

TYPICAL USE CASES FOR E-BUSINESS SUITE

- Monitor interface tables
 - Document solution for errors
 - Allow easy fixing of common errors
 - Provide graphical overview on status
- Build 'Excel-Like' Reports for End Users
- Build complete custom applications

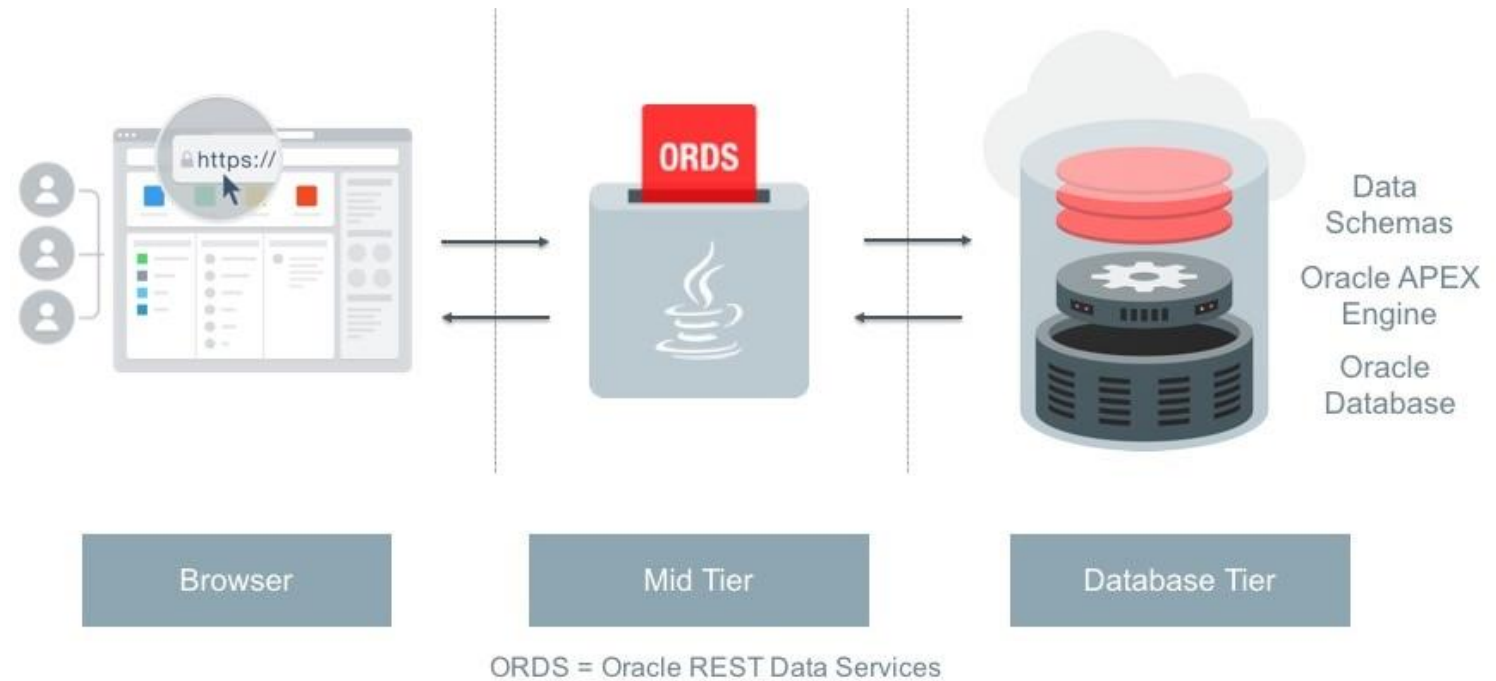


Interface line attribute1	Error message	Sales order	Header attribute13	Interface line attribute6	Trx number	Batch source name	GI date
1003881152	Wenn die Zahlungsart "Automatisch" ist, müssen Sie ein Bankkonto eingeben oder sicherstellen, dass ein primäres Konto für die Transaktionswährung für diesen Rechnungskunden eingerichtet wurde	1003881152	117513224	168500671	117513224	DE_INVOICE_IMPORTED	02-APR-18
1003881152	Wenn die Zahlungsart "Automatisch" ist, müssen Sie ein Bankkonto eingeben oder sicherstellen, dass ein primäres Konto für die Transaktionswährung für diesen Rechnungskunden eingerichtet wurde	1003881152	117513224	168500672	117513224	DE_INVOICE_IMPORTED	02-APR-18
1003881152	Wenn die Zahlungsart "Automatisch" ist, müssen Sie ein Bankkonto eingeben oder sicherstellen, dass ein primäres Konto für die Transaktionswährung für diesen Rechnungskunden eingerichtet wurde	1003881152	117513224	168500670	117513224	DE_INVOICE_IMPORTED	02-APR-18
1003975576	Rechnungs-Nr. bereits vorhanden	1003975576	117580156	169387096	117580156	DE_INVOICE_IMPORTED	14-APR-18
1003975576	Rechnungs-Nr. bereits vorhanden	1003975576	117580156	169387094	117580156	DE_INVOICE_IMPORTED	14-APR-18
1003975576	Rechnungs-Nr. bereits vorhanden	1003975576	117580156	169387098	117580156	DE_INVOICE_IMPORTED	14-APR-18
1003975576	Rechnungs-Nr. bereits vorhanden	1003975576	117580156	169387097	117580156	DE_INVOICE_IMPORTED	14-APR-18
1003612828	Angegebenes Buchungsdatum ist in geschlossener Periode	1003612828	117369762	166293288	117369762	DE_INVOICE_IMPORTED	14-FEB-18
1003612828	Angegebenes Buchungsdatum ist in geschlossener Periode	1003612828	117369762	166293289	117369762	DE_INVOICE_IMPORTED	14-FEB-18
1003612828	Angegebenes Buchungsdatum ist in geschlossener Periode	1003612828	117369762	166293290	117369762	DE_INVOICE_IMPORTED	14-FEB-18
1003612828	Angegebenes Buchungsdatum ist in geschlossener Periode	1003612828	117369762	166293291	117369762	DE_INVOICE_IMPORTED	14-FEB-18
1003612828	Angegebenes Buchungsdatum ist in geschlossener Periode	1003612828	117369762	166293292	117369762	DE_INVOICE_IMPORTED	14-FEB-18
1003612828	Angegebenes Buchungsdatum ist in geschlossener Periode	1003612828	117369762	166293293	117369762	DE_INVOICE_IMPORTED	14-FEB-18
1003612828	Angegebenes Buchungsdatum ist in geschlossener Periode	1003612828	117369762	166293295	117369762	DE_INVOICE_IMPORTED	14-FEB-18

WHAT IS APEX? ARCHITECTURE



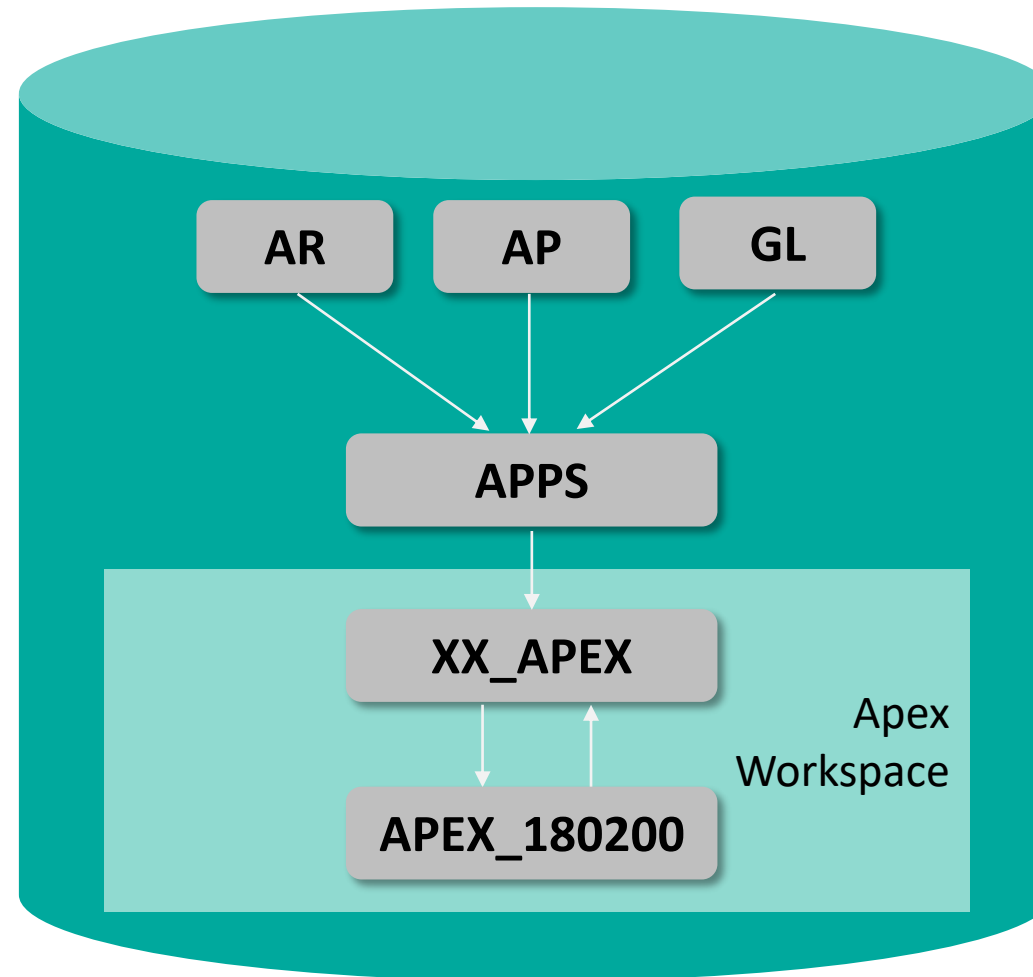
- 3-tier architecture
- Requests are sent from browser through web server to database
- Vice versa for the response
- Business logic is executed in the database



Source: www.oracle.com

WHAT IS APEX?

DATABASE ARCHITECTURE





1	What is APEX?
2	Integration between Oracle EBS and APEX
	Authentication
	Authentication plus
3	APEX on Mobile / PWA
4	Summary

INTEGRATION BETWEEN ORACLE EBS AND APEX

ACCESSING APEX FROM E-BUSINESS SUITE



- There is an Oracle whitepaper describing this (in general):
 - Extending Oracle E-Business Suite Release 12.1.3 and Above Using Oracle Application Express (APEX) (Doc ID 1306563.1)
- Access through HTML and Forms menu but also out of custom Forms/Personalization
- Navigation from APEX to E-Business Suite (e.g. open specific Invoice in Forms) possible:
`fnd_run_function.get_run_function_url`

INTEGRATION BETWEEN ORACLE EBS AND APEX ACCESSING APEX FROM E-BUSINESS SUITE



Enterprise Search | All | Los | Anzeigevoreinstellung für Suchanfrage | Angemeldet als X_MICHLER

Oracle Applications - Homepage

- X04 - O2C TVP Admin
- X05 - O2C Globale Abrechnung
- X06 - O2C Faktura
- X07 - ISD All Reports
- X21 - SU Angebot
- X22 - SU Vertrieb
- X23 - SU Lager
- X24 - SU Debitoren
- X25 - SU Perioden
- X26 - SU HRMS
- X27 - SU CRM Manager
- X28 - SU Payables
- X29 - SU Einkauf
 - Lieferantenartikelkatalog
 - Artikel anzeigen
 - Generieren
 - Benachrichtigungen - Übersicht
 - Organisation wechseln
 - Prozesse
 - Eigene Profilooptionen
 - Reports Key-User
 - EK Online-Fehlerrückmeldung - Textseite
 - Zahlung bei WE - Sammelrechnung
 - XXIS: NP Clearing Maske
 - XXIS: Stammdaten für SOA NP Interface
 - Einkäuferkonsole
 - Anforderungen
 - Bestellungen
 - Warenannahme
 - Angebotsanfragen und Angebote
 - Lieferanten
 - Management
 - Artikel
 - Buchungen
 - Auswertungen
 - Einrichten
 - Workflowbenutzer
 - Advanced Pricing

Arbeitsliste

Vollständige Liste (3)

Benutzer wechseln

Von	Art	Betreff	Gesendet	Fällig
System: Tests		PL/SQL-Nachricht zum Testen des Workflow-Benachrichtigungs-Mailers - PROD	06.08.2014	
System: Tests		OA Framework-Nachricht für den Test des Workflow-Benachrichtigungs-Mailers - PROD	06.08.2014	
System: Tests		OA Framework-Nachricht für den Test des Workflow-Benachrichtigungs-Mailers - PROD	23.04.2011	

✓TIPP Abwesenheitsregeln - Nachrichten können automatisch beantwortet oder zur Beantwortung weitergeleitet werden.

✓TIPP Arbeitslistenzugriff - Geben Sie an, welche Benutzer zum Anzeigen und Bearbeiten Ihrer Benachrichtigungen berechtigt sind.

Form Functions

Description Properties Form Web HTML Web Host Region

Function	HTML Call
XXIS_NP_CLEARING	GWY.jsp?targetAppType=APEX&p=2000:1000::

Navigator - ISD_Einkauf_Admin

Funktionen Dokumente Prozesse

XXIS: NP Clearing Maske

- + Einkäuferkonsole
 - Lieferantenartikelkatalog
 - Artikel anzeigen
- + Anforderungen
- + Bestellungen
 - Generieren
- + Warenannahme
- + Angebotsanfragen und Angebote
- + Lieferanten
- + Management
- + Artikel
 - Benachrichtigungen - Übersicht
- + Auswertungen
 - Organisation wechseln
- + Einrichten
 - Prozesse
- + Advanced Pricing
 - Eigene Profilooptionen
 - Reports Key-User
- + Bestelldokumente anzeigen
 - EK Online-Fehlerrückmeldung - Textseite
- + Meldungsverarbeitung
- + Cockpit
 - Zahlung bei WE - Sammelrechnung
- + Schnittstellen-Überwachung
 - XXIS: NP Clearing Maske
 - XXIS: Stammdaten für SOA NP Interface

INTEGRATION BETWEEN ORACLE EBS AND APEX AUTHENTICATION



- Application Express Account
- Database Account
- LDAP Directory
- Open Door Credentials
- Oracle Application Server Single Sign-On
- Social Sign-In
 - e.g. Oracle Identity Cloud Service
- Custom Authentication
- HTTP Header Variable
 - e.g. Oracle Access Manager / Webgate

INTEGRATION BETWEEN ORACLE EBS AND APEX AUTHENTICATION



Authentication Scheme

CancelApply Changes

Show All	Name	Subscription	Settings	Source	Session Not Valid	Login Processing	Post-Logout URL	Session Cookie Attributes	Comments
----------	------	--------------	----------	--------	-------------------	------------------	-----------------	---------------------------	----------

Name

* NameOracle EBS Authentication?

* Scheme TypeCustom?

Subscription

Reference Master Authentication Scheme From ^?

☒ Refresh?

This is the "master" copy of this authentication scheme.

There are no subscribers to this authentication scheme.

Settings

Sentry Function Name

Invalid Session Procedure Name

Authentication Function Name

Post Logout Procedure Name

Enable Legacy Authentication AttributesNo?

INTEGRATION BETWEEN ORACLE EBS AND APEX

POSSIBLE AUTHENTICATION MECHANISMS



Oracle Access
Manager

Consider Oracle IDCS!

Pros

- Full single sign on between EBS and APEX
- One user
- One Password
- Just one login
- Only Single Sign On method described in 1306563.1
- Can integrate with even more applications

Cons

- Additional license costs
- Complex to implement

INTEGRATION BETWEEN ORACLE EBS AND APEX

POSSIBLE AUTHENTICATION MECHANISMS



APEX/Database User Account

Pros

- Easy to implement

Cons

- No password synchronization
- No direct connection between login and EBS user
- Password has to be typed in separately

INTEGRATION BETWEEN ORACLE EBS AND APEX

POSSIBLE AUTHENTICATION MECHANISMS



EBS user account
(Single
authentication)

Pros

- Only one password is needed
- Password for APEX and EBS are in sync
- Connection between APEX login and EBS User is available
- Easy to implement
- Described in note 1306563.1

Cons

- Password has to be typed in separately

INTEGRATION BETWEEN ORACLE EBS AND APEX

POSSIBLE AUTHENTICATION MECHANISMS



EBS user account
(Single sign on)

Pros

- Only one password is needed
- Password for APEX and EBS are in sync
- Connection between APEX login and EBS User is available
- Single Sign on from EBS -> APEX

Cons

- Several ways to implement (some with big security issues)
- Complex to do it secure!

INTEGRATION BETWEEN ORACLE EBS AND APEX

POSSIBLE AUTHENTICATION MECHANISMS



EBS user account
(Single sign on)

- Pass username as clear text in the URL to APEX
- Username can easily be read
- Possible to hack APEX even without direct EBS access



High security issues

INTEGRATION BETWEEN ORACLE EBS AND APEX

REQUIREMENTS: 'AUTHENTICATION PLUS'



Login/SSO

- EBS session ID, responsibility, user and organization should be handed over to APEX via URL in a 'secure way'
- Coming from EBS, no password should be needed for APEX login

Session Management

- Every call of an APEX page should tickle the EBS session (if started from there)
- If the session timed out, the user should be redirected to the EBS login
- The logout button in APEX and EBS should destroy the corresponding session in the other application as well
- User should be able to login into APEX itself without logging into EBS

INTEGRATION BETWEEN ORACLE EBS AND APEX

REQUIREMENTS: 'AUTHENTICATION PLUS'



Menu in APEX

- The menu in APEX is controlled by the security function within the EBS

Authorization

- Every page in APEX needs a connection to an EBS function
- On page access the functions checks, if the user has access to the corresponding EBS function

Context initialization

- If needed, the APEX page must do a context initialization for the EBS tables

Passing Parameters

- Have ability to pass Parameters into APEX out of e.g. Forms (personalization)

INTEGRATION BETWEEN ORACLE EBS AND APEX AUTHENTICATION PLUS



Login/SSO

EBS session ID, responsibility, user and organization should be handed over to APEX via URL in a „secure way“

- Generating encrypted token with EBS session information
 - Generation is a DB function, which can be called from customized GWY in the EBS
 - Expires after 5 seconds
- Key for encrypting only available in the database
- URL rewriting to get rid of token information (deep linking)
- Decrypt and extract token in APEX to start APEX session
 - Store information in APEX Application items

INTEGRATION BETWEEN ORACLE EBS AND APEX AUTHENTICATION PLUS



Login/SSO

Coming from EBS, no
password should be
needed for APEX login

- APEX sentry function is used to check the token information against the EBS sessions
 - Sentry function can be used to determine whether the current session is valid or not
- With the session information from the token the EBS session is tried to tickle
 - Possible: Session is alive and can be used in APEX
 - Impossible: Redirect to the login form (EBS session is no more valid)

INTEGRATION BETWEEN ORACLE EBS AND APEX AUTHENTICATION PLUS



Session Management

- More or less covered by the sentry function
- Every server call triggers the sentry function
 - Check if the session is valid or not
 - Tickle the session if possible
- Logout in APEX will link to the EBS logout URL
 - Kills APEX and EBS session
- Direct login into APEX is enabled by custom auth function
 - Calls EBS standard `validate_login` function

INTEGRATION BETWEEN ORACLE EBS AND APEX AUTHENTICATION PLUS



Context initialization

If needed, the APEX page must do a context initialization for the EBS tables

- Token contains all needed information about EBS context
- Apps init has to be done in sentry function
- For login directly in APEX, apps init can be done with user information only

INTEGRATION BETWEEN ORACLE EBS AND APEX

DEMO: AUTHENTICATION PLUS

The screenshot displays the Oracle E-Business Suite homepage. The top navigation bar includes the Oracle logo, 'E-Business Suite', and links for 'Abmelden', 'Voreinstellungen', and 'Hilfe'. Below this is an 'Enterprise Search' section with a dropdown menu set to 'All' and a search button labeled 'Los'. The user is logged in as 'YCHASSEIN'.

The main content area is titled 'Oracle Applications - Homepage'. On the left is a navigation tree with the following items:

- Workflows
- Oracle Web Applications
- Dictionary
- Sicherheit
- Generischer Dateimanager
- Systemadministration
 - Übermittlungsoptionen
 - Anforderungen planen
 - Hintergrundprozesse überwachen
 - Meldungen
 - Allgemeine
- Anwendungsoptionen
 - Anwendungssystemstatus
 - Lookup Types
 - Pläne verwalten
 - APEX-Demo1** (highlighted by a mouse cursor)
 - APEX-DEMO2
- ProzessSet
- Oracle Applications Manager
 - Hilfesystem verwalten
 - Hintergrund
 - Prozesse
 - Diagnose

On the right, the 'Arbeitsliste' (Worklist) section is shown. It contains a table with the following columns: 'Von', 'Art', 'Betreff', 'Gesendet', and 'Fällig'. The table is currently empty, with a message stating 'Diese Ansicht enthält keine Benachrichtigungen.' (This view contains no notifications). Above the table is a button labeled 'Vollständige Liste'.

INTEGRATION BETWEEN ORACLE EBS AND APEX

DEMO: AUTHENTICATION PLUS



☰

APEX EBS DEMO

Log Out

Home

EBS14

EBS_APP_ID

EBS_APP_ID1

Die Responsibility Application ID, über die der Benutzer sich im APEX authentifiziert hat. Wird nicht gesetzt, wenn der Benutzer sich direkt über die APEX Login Seite einloggt.

EBS_FUNCTION_ID

EBS_FUNCTION_ID48315

Die ID der EBS Funktion, über die der Benutzer sich im APEX authentifiziert hat. Wird nicht gesetzt, wenn der Benutzer sich direkt über die APEX Login Seite einloggt.

EBS_HOME_URL

EBS_HOME_URLhttp://ebs14srv.intern.promatis.de:8000/OA_HTML/OA.jsp?OAFunc=OAHOMEPAGE

Wenn der Benutzer von der EBS über den SSO kommt, dann steht hier die Home URL der EBS. Andernfalls enthält dieses Item die Home URL von APEX selbst.

EBS_LOGOUT_URL

EBS_LOGOUT_URLhttp://ebs14srv.intern.promatis.de:8000/OA_HTML/OALogout.jsp

Wenn der Benutzer von der EBS über den SSO kommt, dann steht hier die EBS Logout URL. Nach dem APEX Logout wird auf diese URL verlinkt und somit wird auch die EBS Session beendet. Sollte sich der Benutzer direkt über die APEX Login Seite eingeloggt haben, so steht hier die URL der APEX Login Seite. Nach dem APEX Logout wird der Benutzer also auf die APEX Login Seite weitergeleitet.

EBS_RESP_ID

EBS_RESP_ID20420

Enthält Responsibility ID über die sich der Benutzer via SSO ins APEX eingeloggt hat. Wird nur im Fall eines SSO gesetzt.

EBS_SESSION_ID

EBS_SESSION_ID1261777482

Enthält die Session ID des Benutzers aus der EBS, wenn er sich via SSO im APEX angemeldet hat. Wird nur im Fall eines SSO gesetzt.

EBS_TOKEN

EBS_TOKEN4EC23DCD359E1687221F2D1C6AD4678A4EC8EEB00F7F7361C4DB8AB62AD2A0B25DBAA4

Enthält das Token, welches in der URL gesetzt wird, wenn der Benutzer auf einen APEX SSO Link in der EBS klickt.

EBS_TOKEN_SECURE

EBS_TOKEN_SECURE4EC23DCD359E1687221F2D1C6AD4678A4EC8EEB00F7F7361C4DB8AB62AD2A0B25DBAA4

Enthält ebenfalls das Token, über das sich der Benutzer im APEX authentifiziert hat. Dieses Item ist allerdings im Vergleich zu EBS_TOKEN geschützt, sodass es nicht ausversehen verändert werden kann. Im Fall eines manuellen Einloggens über die APEX Login Seite enthält dieses Item ein spezielles Token, mit dessen Hilfe unterschieden werden kann, ob sich der Benutzer manuell eingeloggt hat oder ob er über den SSO Mechanismus eingeloggt wurde.

EBS_USER_ID

EBS_USER_ID1951

Enthält die User ID des Benutzers aus der EBS. Wird in beiden Login Fällen gesetzt, da man sich im APEX ebenfalls mit den EBS Benutzerdaten anmeldet.

EBS_USER_NAME

EBS_USER_NAMEYCHASSEIN

Enthält den Benutzernamen des Benutzers aus der EBS. Wird in beiden Login Fällen gesetzt, da man sich im APEX ebenfalls mit den EBS Benutzerdaten anmeldet.



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APEX 'STANDARD' MOBILE MOBILE THEME



- 'Extra Theme' with increased focus on performance and stability
- More lightweight than the Universal Theme
- Based on jQuery Mobile
- Advantage: optimized components like List View or Reflow Report for mobile devices
- Disadvantage: two applications need to be developed to support mobile and desktop devices

APEX 'STANDARD' MOBILE MOBILE THEME



John Dulles Sterling, VA	703-555-2143	>
William Hartsfield Atlanta, GA	404-555-3285	>
Edward Logan East Boston, MA	617-555-3295	>
Frank OHare Chicago, IL	773-555-7693	>
Fiorello LaGuardia Flushing, NY	212-555-3923	>



- Since APEX 5, the Universal Theme has been included
- Responsive; based on HTML5 and CSS3
- Grid Layout provides an 'optimal' positioning of page elements
- When using JavaScript libraries that don't support mobile applications, a wrapper is needed
- Advantages:
 - No separate application needed
 - No extra templates needed
- Disadvantages:
 - ,Large' reports are hard to use
 - Multi-touch does not run 100% smoothly
 - Not all device resources can be accessed (only access to resources the browser can access)

APEX 'STANDARD' MOBILE UNIVERSAL THEME

Sample Database Applicat

Sample Database Application
Track and Manage Customers, Orders and Products

Search customers, orders & products

Dashboard

\$3,565
Monthly Sales

4
Monthly Orders

10
Total Products

7
Total Customers

Top Customers

Bradley, Eugene
Windsor Locks, CT · 1,000

Logan, Edward
East Boston, MA · 1,000

Dulles, John
Sterling, VA · 1,000

Hartsfield, William
Atlanta, GA · 1,000

LaGuardia, Fiorello
Flushing, NY · 1,000

Sample Database Applicat

Orders

Calendar

Place Order

Q

Go

1. Primary Report

Rows 15

Actions

Order #

Customer Name

Order Date

Order Items

Order Total

0010

Bradley, Eugene

11/18/2019

3

\$870.00

0009

Hartsfield, William

11/15/2019

3

\$730.00

0008

OHare, Frank

11/9/2019

4

\$1,060.00

0007

Logan, Edward

11/1/2019

7

\$905.00

0006

Logan, Edward

10/27/2019

4

\$1,515.00

0005

Lambert, Albert

10/22/2019

5

\$950.00

0004

LaGuardia, Fiorello

10/12/2019

5

\$1,090.00

0003

Hartsfield, William

10/10/2019

5

\$1,640.00

Dulles

Sample Database Applicat

Orders

Calendar

Place Order

Order Details

Order Number
10

Customer Info
Eugene Bradley
Schoephoester Road
Windsor Locks, CT 06096

Order Date
18-NOV-2019 08:26AM

Order Total
\$870.00

Sales Rep
DEMO

Tags

Cancel

Delete

Apply Changes

0003

Hartsfield, William

10/10/2019

5

\$1,640.00

09:43 5° 89 %

1.oraclecloudapps.com

Sample Database Application - Custome...

Eugene

Last Name *

Bradley

Street Address

Schoephoester Road

Line 2

City

Windsor Locks

State *

Connecticut

Zip Code *

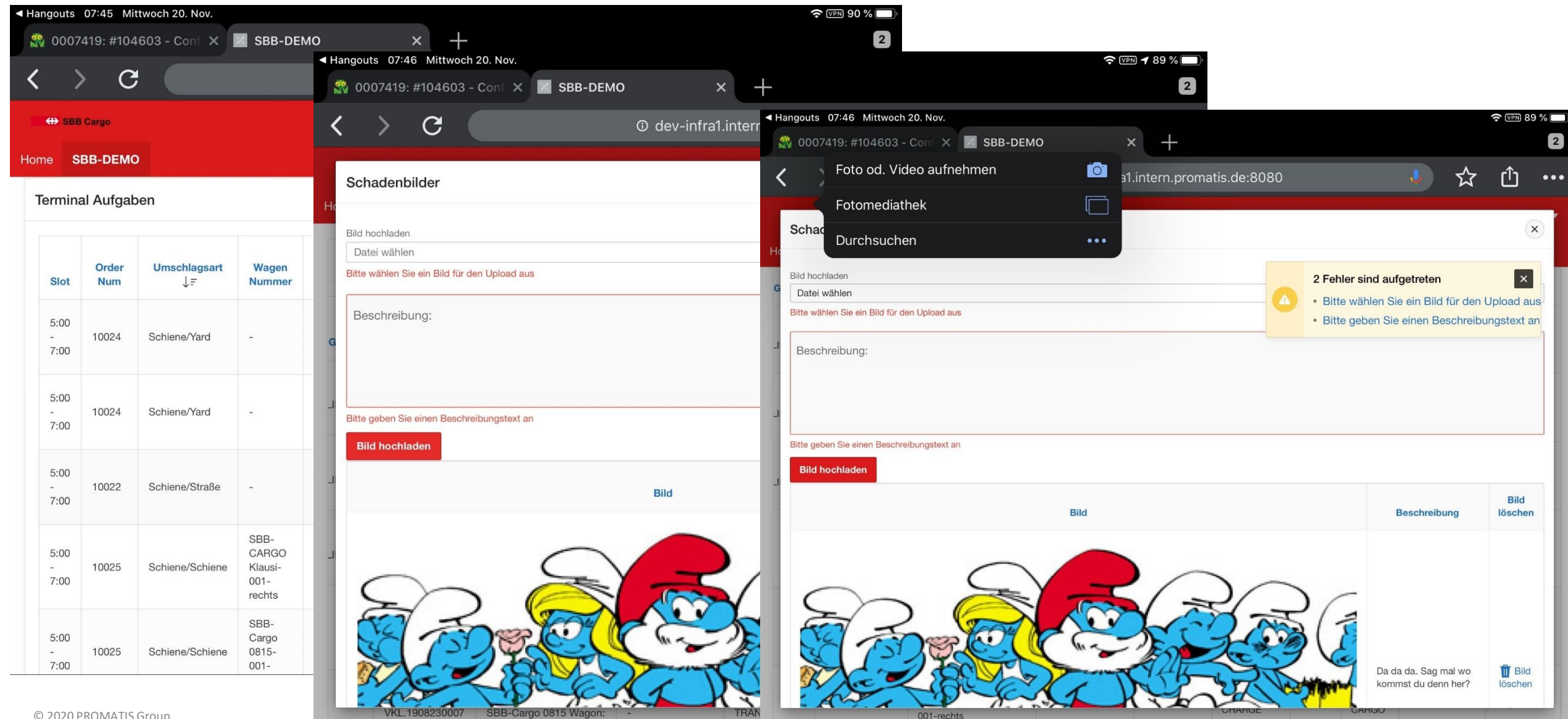
06096

Cancel

Delete

Apply Changes

APEX 'STANDARD' MOBILE UNIVERSAL THEME





- PWA stands for ‘progressive web app’
- Website that functions and behaves a lot like a native app
 - Symbiosis of responsive website and app
- The PWA concept bridges the gap between websites and native apps
- Characteristic functions for PWAs
 - Offline capability with background synchronization
 - Push notifications
 - ‘Add-To-Home Screen’



- Goals of PWAs:
 - More reliable than web applications due to ‘offline capability’
 - Faster than normal web application due to cache API
 - More inviting than normal web applications since no lengthy URLs need to be typed out and direct notifications can be sent

MOBILE NEXT GEN – PWA WITH APEX

CONCEPTS – MANIFEST.JSON



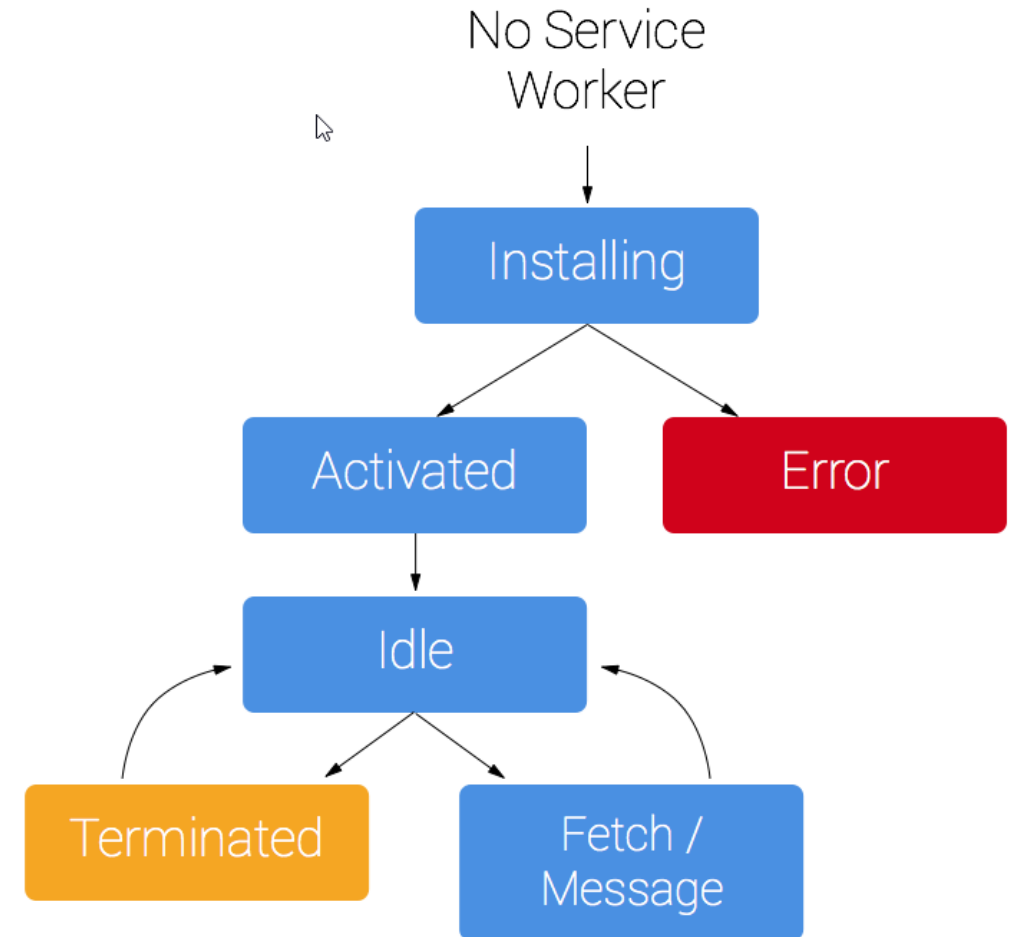
- Contains configuration to install website natively as app
- Final app cannot only be installed on mobile devices but also on desktop devices
- This app cannot be added to any app store → tools like Cordova are needed
- Manifest.json must be located at root level of the APEX server
 - Or addition of appropriate 'rewrite rules'

```
{  
  "name": "APEX Mobile @ DOAG 2019",  
  "short_name": "APEX Mobile",  
  "start_url": "https://access.promatis.de/r/1694/files/static/v2997/sw.js",  
  "display": "standalone",  
  "orientation": "portrait-primary",  
  "background_color": "#fff",  
  "theme_color": "#3f51b5",  
  "description": "An example of APEX as a Progressive Web Application",  
  "dir": "ltr",  
  "lang": "en-US",  
  "gcm_sender_id": "103953800507",  
  "icons": [  
    {  
      "src": "/r/1694/files/static/v2997/images/icons/icon-72x72.png",  
      "type": "image/png",  
      "sizes": "72x72"  
    },  
  ],  
}
```

MOBILE NEXT GEN – PWA WITH APEX

CONCEPTS – SERVICE WORKER

- JavaScript construct
- Runs asynchronously in the background of the application
- Uses its own cache
- Cannot directly manipulate the DOM tree
- Exchange via message-based interface with the 'main'
- Has several requirements
 - HTTPS
 - Browser must support Service Worker



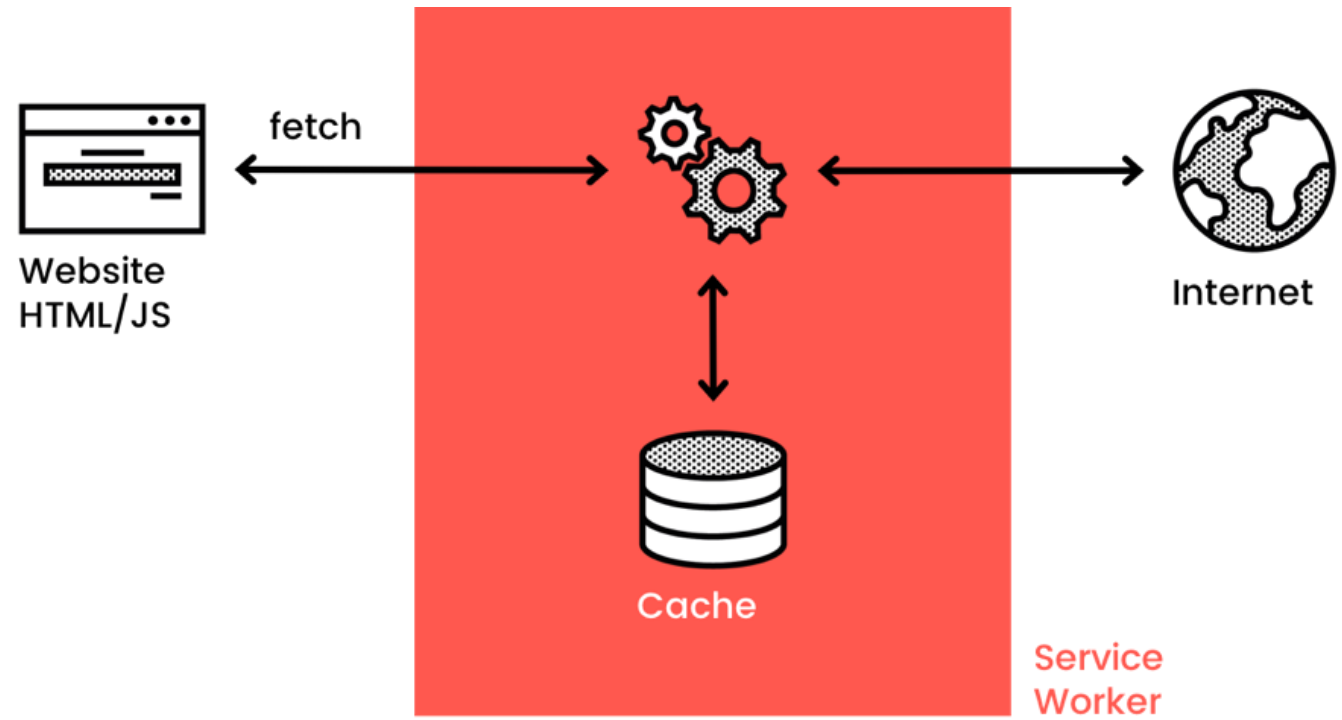
Source: <https://developers.google.com/web/fundamentals/primers/service-workers>

MOBILE NEXT GEN – PWA WITH APEX

CONCEPTS – SERVICE WORKER



- Intercepts site requests
- Can decide to serve requests from the cache



Source: <https://www.heise.de/developer/artikel/Progressive-Web-Apps-Teil-2-Die-Macht-des-Service-Worker-3740464.html>

MOBILE NEXT GEN – PWA WITH APEX

CONCEPTS – BACKGROUND SYNCHRONIZATION



- Temporary storage of data (for the offline scenario)
- Resynchronize when online
- Use of a 'persistent storage' → 'indexed DB'
- Indexed DB works with JavaScript and Service Workers

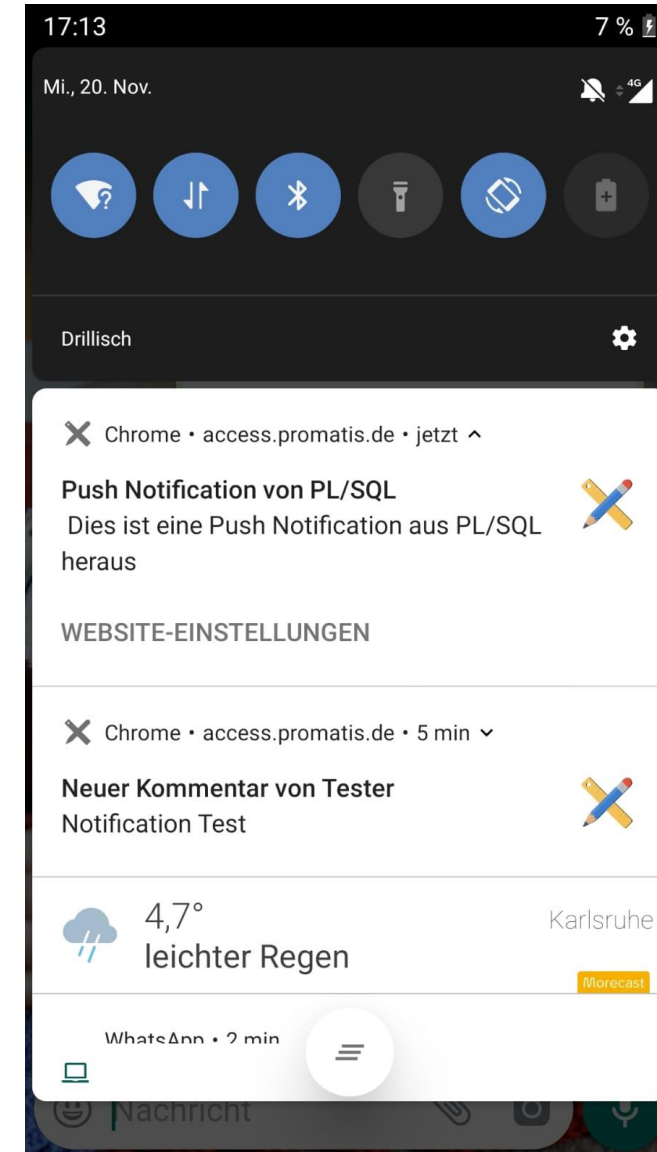
The screenshot shows the Chrome DevTools Application tab. The left sidebar has a tree view with 'Application' expanded, showing 'Manifest', 'Service Workers', and 'Clear storage'. Under 'Storage', 'IndexedDB' is expanded, showing a database named 'pwa-offline-tasks - https'. The 'keyvaluepairs' section is selected. The main pane shows a table with one entry:

#	Key	Value
0	"4149f5ca-fba1-4136-be96-59692ff8a12e"	<pre>{endpoint: "/pwa-offline-tasks/pwa-comment", options: {...}, refreshReportId: "comments-report"} endpoint: "/pwa-offline-tasks/pwa-comment" options: {method: "POST", headers: {...}, body: '{"pwa_comment": "Test", "pwa_comment_by": "Offline Test 2"}'} refreshReportId: "comments-report"}</pre>

At the bottom of the table, it says 'Total entries: 1'. A mouse cursor is pointing at the 'Value' cell.

MOBILE NEXT GEN – PWA WITH APEX CONCEPTS – PUSH NOTIFICATIONS

- Firebase by Google used as a basis
- Notification can be triggered via JavaScript and PL/SQL
- Node.js application on the server as a counterpart





- Complete Sample with Autonomous Data Base

<https://www.promatis.de/2020/02/25/building-a-minimal-progressive-web-app-pwa-on-autonomous-apex/>



1	What is APEX?
2	Integration between Oracle EBS and APEX
3	APEX on Mobile / PWA
4	Summary

SUMMARY – WHY YOU SHOULD START USING APEX (NOW)



- APEX is easy to learn for Oracle PL-SQL/Reports/Forms developers
- More customizable interface than e.g. EBS Forms
- Reporting features of APEX to review EBS data
 - Reports are customizable
 - Reports are printable
- Responsive design of APEX is suitable for mobile devices
 - Increased availability and accessibility
 - Even sophisticated PWAs are possible with APEX
- Accessible from a web browser
 - No Java or Java Web Start needed on the client!
- It's possible to have Single Sign On between APEX and EBS (without additional licenses)

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